SEAMING PLASTIC FILM USING SOLVENT-BASED ADHESIVE BEAD

This application discloses and claims subject matter which was disclosed in provisional patent application Ser. No. 60/352,719, filed Jan. 26, 2002 and titled Seaming Plastic Film Using Solvent-Based Adhesive Bead.

TECHNICAL FIELD

This invention pertains to the field of using a solvent-based adhesive to form a continuous, adhesively bonded and welded seam at the longitudinal edge portions of plastic film which have been overlapped, as for example in making continuous sleeves of plastic film by folding a single web of film into a tube and then forming the seam at its opposite longitudinal edge portions.

Uses of such sleeves include decorative and protective labels for food products such as coffee creamer and sweetener in plastic, glass or metal containers. Typically, heat-shrinkable sleeves are printed with graphics and text, cut to length, and heat-shrunk onto and around both ends of the food containers.

BACKGROUND ART

The art of adhesively seaming plastic film to make sleeves is fairly well developed. It is well known that the seams should meet certain basic requirements as well as specific requirements of particular foods and their containers. These basic requirements include speed and efficiency in manufacturing the sleeves and in applying them to a food container, as well as strength, appearance, reliability, and minimum tendency to snag, after the sleeves have been heat-shrunk onto a food container. In one way or another an ability to meet and exceed these requirements benefits the sleeve manufacturer, the food product supplier who applies the sleeves to food containers, and the consumer who purchases the food product and opens the container.

Prior art technology for using solvent-based adhesives to manufacture seamed sleeves of plastic film has required that an applicator contact the film. Such applicators employ either a felt wick or a wheel to apply the adhesive to the film. This technology has inherent problems that reduce efficiency. Felt applicators tend to pick up foreign matter from the surface of the film, causing the felt to plug. A second challenge with felt applicators is consistent delivery of adhesive to the wick and then onto the film. Wheel applicators transfer adhesive to the film from a delivery system such as another wheel or a felt pad. Wheel applicators have problems with pickup of foreign matter, wear on the wheel, and out-of-round conditions on the wheel or backup roll. All of the problems described for felt and wheel applicators result in inconsistent application of solvent. This in turn results in the following:

1. Open seams caused by adhesive skips that are severe enough to result in areas where there is no adhesive.
2. Blocked rolls, a condition which occurs when there is too much adhesive and the excess adhesive goes outside of the overlap seam, adhering the seam area to the next layer on the roll.
3. Uneven seam width, a condition in which the width of the adhesive bead varies, making it difficult to seam close to the edge of the film without causing blocked rolls.
4. Weak seams, which result from insufficient adhesive to create a strong bond.

Line speed and the amount of ink or other foreign material in the seam area, as well as temperature and humidity, may aggravate these problems.

Another problem with prior art contact applicators is that they must apply the adhesive in a relatively wide band of generally rectangular cross-section. FIGS. **1** and **2** show film **2** on which such a band of adhesive **4** has been applied. The width of adhesive **4** requires wider seams and exacerbates the problems of controlling the location of the adhesive with respect to the edge portions of the film. Moreover, the uniform thickness (height) of the adhesive band promotes "dog bones", a term which refers to the cross-sectional shape of adhesive and dissolved film after the film has been squeezed between nip rolls. FIG. **2** shows the adhesive and dissolved film **6** having such a dog bone shape in the final seam. The dog bone shape is undesirable because it tends to cause adhesive to flow beyond one or both film edges, where it will result in blocked rolls.

Another problem with prior art contact applicators is that, in order to accommodate varying workpiece (i.e., "line" or "film") speeds, the quantity of adhesive applied to the film is adjusted by measures aimed directly at increasing the volumetric flow of adhesive, as for example varying the speed of a pump supplying the adhesive to the wick or valving that restricts the flow. Such measures complicate control of the process.

In other prior art technology, a bead of hot melt adhesive is extruded onto the film just before the seam is passed between the nip rolls. See, for example, Clark U.S. Pat. No. 2,926,723. This technology introduces a different set of problems, some of which are identified and addressed by the Clark patent.

SUMMARY OF THE INVENTION

The seaming process according to the invention consists of two basic steps.

First, a bead applicator is used to apply a narrow but swelling bead of solvent-based adhesive to moving plastic film. The adhesive bulges above the surface of the film by virtue of its own surface tension. The seam is kept open to the air for a period of time, which depends upon the running speed of the film. During this time the adhesive partially dissolves a channel in the film to which it was applied. A portion of the adhesive settles into the channel and the remainder is left bulging above the surface in a mushroom profile.

The second step is to bring the layer of film with the adhesive disposed in its channel into contact with a second layer of film and to create the adhesive joint (i.e., a uniform band of the adhesive and dissolved film) by pressing the two layers together. During this step the adhesive that remained above the surface of the film in the first step of the process is spread out under pressure, creating a joint with a rounded hat-shaped cross-sectional profile.

The invention utilizes an adjustable dispensing valve having a replaceable hollow, tubular dispensing tip mounted on one end, very close to film passing over an applicator roll. The passage in the tip has a round cross-sectional profile, preferably either circular or elliptical with the major axis to the ellipse parallel to the roll surface, and is sized so that a constant stream of adhesive is maintained across the gap. The valve is calibrated to deliver a set volume of adhesive at a predetermined pressure. Varying the pressure on the adhesive delivery line automatically and precisely controls